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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/699,252	10/30/2003	Seong Deok Ahn	5882P016D	2543

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EXAMINER

PERRY, ANTHONY T

ART UNIT PAPER NUMBER

2879

DATE MAILED: 05/19/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/699,252

Applicant(s)

AHN ET AL.

Examiner

Anthony T Perry

Art Unit

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 30 October 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-5 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-5 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 30 October 2003 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
- 1) ☐ Certified copies of the priority documents have been received.
 - 2) ☒ Certified copies of the priority documents have been received in Application No. 10/160,413.
 - 3) ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date 10/30/03
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Drawings

Figure 1 should be designated by a legend such as --Prior Art-- because only that which is old is illustrated. See MPEP § 608.02(g). A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ito et al. (JP 2001-266737) in view of Takada et al. (US 5,965,972).

Ito et al. (US-6,670,747) is the counterpart to the Japanese patent 2001-266737, and is used to cite teachings of the Japanese patent for simplicity purposes.

Regarding claim 1, the Ito reference teaches a field emission device (see Fig. 2) comprising an insulating layer (20) formed on the emitter electrode (22) and has a nanohole (not labeled) that exposes the emitter electrode (22). A gate electrode (26) is formed on the insulating layer (20).

Ito does not specifically teach a silicon substrate having the emitter electrode formed in a surface portion thereof. However, Takada teaches a field emission cold cathode capable of preventing continuous discharge and resultant destruction of the emitter without using an additional

element, such as a resistor and an FET, connected to the emitter. Takada teaches in Figure 18, an n-type silicon substrate 1, a plurality of n⁺-type regions 16 (emitter electrode formed within the silicon substrate) formed in the n-type silicon substrate 1, a plurality of emitters 2 formed on the n⁺-type regions 16, a buried insulator layer 3 formed in the n-type silicon substrate 1, an insulator layer 4, and a gate electrode 5. The n⁺-type regions 16 are heavily-doped n-type regions formed by diffusing impurities in the n-type silicon substrate 1. Each of the n⁺-type regions is formed in the vicinity of the surface of the n-type silicon substrate 1. The buried insulator layer 3 surrounds the n⁺-type regions 16 and underlying regions of the n-type silicon substrate 1 right under the emitters 2. Each of the emitter cones 2 is formed on the n⁺-type regions 16 in one-to-one correspondence. Thus, each of the n⁺-doped regions 16 is interposed between the n-type silicon substrate 1 and the bottom of each of the emitter, (col. 13, line 55 - col. 14, line 2).

Accordingly, it would have been obvious to one having ordinary skill in the art at the time, the invention was made to have utilize the diffused emitter electrode of Takada for the electron emitting device of Ito in order to prevent continuous discharge and resultant destruction of the emitter without using an additional element and further avoid an increase of contact resistance between the bottom of the emitter and the substrate.

Regarding claim 2, Takada teaches the emitter electrode being formed by an impurity implantation (col. 13, line 55 – col. 14, line 2).

Reasoning for combination given in the rejection of claim 1 applies.

Regarding claims 3-5, Ito teaches the emitters being carbon nanotubes (col. 4, lines 46-53). Ito does not specifically state that a catalyst is formed between the emitters and the emitter electrode. However, Ito teaches the emitter electrode being a transition metal (col. 4, lines 44-45). It is well known that transitions metals are used as catalysts in the growth of carbon

nanotubes. Therefor, layer 22 of Fig. 2 serves the purpose of catalyst for nanotube growth as well as an emitter electrode for the FED.

However, the combined invention, as taught in the rejection of claim 1, has an emitter electrode formed in the silicon substrate (not a separate layer comprising a transition metal). Furthermore, using a separate catalyst layer helps control and focus the growth and placement of the nanotube emitters. Thus, it would have been obvious at the time the invention was made to a person having ordinary skills in the art to incorporate a catalyst layer between the emitter electrode and the nanotube emitters so as to place the nanotubes at a desired location.

It has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. Thus, it would have been obvious to one having ordinary skills in the art at the time the invention was made to have used a transition metal as the catalyst of the combined invention, since the selection of known materials for a known purpose is within the skill of the art.

Reasoning for combination given in the rejection of claim 1 applies.

Other Prior Art Cited

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Lee et al. (US 6,339,281) and Chuang et al. (US 6,062,931) both teach a catalytic layer formed of a transition metal located between an emitter electrode and the carbon nanotube emitters.

Contact Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to *Anthony Perry* whose telephone number is (571) 272-2459. The

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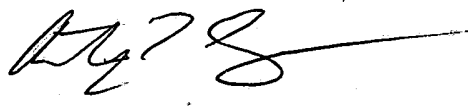
examiner can normally be reached between the hours of 9:00AM to 5:30PM Monday thru Friday.


If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nimesh Patel, can be reached on (571) 272-24597. **The fax phone number for this Group is (703) 872-9306.**

Communications via Internet e-mail regarding this application, other than those under 35 U.S.C. 132 or which otherwise require a signature, may be used by the applicant and should be addressed to [Anthony.perry@uspto.gov].

All Internet e-mail communications will be made of record in the application file. PTO employees do not engage in Internet communications where there exists a possibility that sensitive information could be identified or exchanged unless the record includes a properly signed express waiver of the confidentiality requirements of 35 U.S.C. 122. This is more clearly set forth in the Interim Internet Usage Policy published in the Official Gazette of the Patent and Trademark on February 25, 1997 at 1195 OG 89.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 308-0956.


Anthony Perry
Patent Examiner
Art Unit 2879
May 14, 2004


Vip Patel
Primary Examiner
Art Unit 2879